chiral smectic J, G, K, H → no helix

--31. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising a ferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not having a helical structure of said ferroelectric liquid crystal between said substrates;

an electrode provided over each of said substrates for applying an electric field to said ferroelectric liquid crystal; and

an orientation film provided over one of said substrates,

wherein said electro-optical modulating layer does not have memory characteristic.

32. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising a ferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not having a helical structure of said ferroelectric liquid crystal between said substrates;

an electrode provided over each of said substrates for applying an electric field to said ferroelectric liquid crystal; and

an orientation film provided over one of said substrates,

wherein said electro-optical modulating layer does not have bistability.

monostability

unwound

4,883,344

no helical → bistability

chiral helical ⇒ no bistability

33. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising a antiferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not having a helical structure of said antiferroelectric liquid crystal between said substrates;

an electrode provided over each of said substrates for applying an electric field to said antiferroelectric liquid crystal; and

an orientation film provided over one of said substrates,

wherein said electro-optical modulating layer does not have memory characteristic.

34. The device of claim 31 wherein said electro-optical modulating layer further comprises a resin.

35. The device of claim 32 wherein said electro-optical modulating layer further comprises a resin.

36. The device of claim 33 wherein said electro-optical modulating layer further comprises a resin.

37. The device of claim 34 wherein said resin is provided on said orientation film.

38. The device of claim 35 wherein said resin is provided on said orientation film.

39. The device of claim 36 wherein said resin is provided on said orientation film.

40. The device of claim 34 wherein said resin has a form of a plurality of protrusions.

41. The device of claim 35 wherein said resin has a form of a plurality of protrusions.

42. The device of claim 36 wherein said resin has a form of a plurality of protrusions.

43. The device of claim 34 wherein said resin has a form of a column.

44. The device of claim 35 wherein said resin has a form of a column.

45. The device of claim 36 wherein said resin has a form of a column.

46. The device of claim 34 wherein said resin comprises an acrylic resin.

47. The device of claim 35 wherein said resin comprises an acrylic resin.

48. The device of claim 36 wherein said resin comprises an acrylic resin.

49. The device of claim 31 wherein said liquid crystal electro-optical device is an active matrix type.

50. The device of claim 32 wherein said liquid crystal electro-optical device is an active matrix type.

51. The device of claim 33 wherein said liquid crystal electro-optical device is an active matrix type.

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52. The device of claim 34 wherein said resin has a film shape.

53. The device of claim 35 wherein said resin has a film shape.

54. The device of claim 36 wherein said resin has a film shape.

55. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising a ferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not

having a helical structure of said ferroelectric liquid crystal between said substrates;

an electrode provided over each of said substrates for applying an electric field to said ferroelectric liquid crystal;

an orientation film provided over one of said substrates; and

a resin and a spacer provided between said substrates,

wherein said electro-optical modulating layer does not have memory characteristic.

56. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising an antiferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not having a helical structure of said antiferroelectric liquid crystal between said substrates;

an electrode provided over each of said substrates for applying an electric field to said antiferroelectric liquid crystal;

an orientation film provided over one of said substrates;

a resin and a spacer provided between said substrates;

wherein said electro-optical modulating layer does not have memory characteristic.

57. The device of claim 55 wherein said resin comprises an acrylic resin.

58. The device of claim 56 wherein said resin comprises an acrylic resin.

59. The device of claim 55 wherein said resin has a film shape.

60. The device of claim 56 wherein said resin has a film shape.

61. The device of claim 55 wherein said resin has a form of a plurality of protrusions.

62. The device of claim 56 wherein said resin has a form of a plurality of protrusions.

63. The device of claim 55 wherein said resin has a form of a column.

64. The device of claim 56 wherein said resin has a form of a column.

65. The device of claim 55 wherein said resin is provided on said orientation film.

66. The device of claim 56 wherein said resin is provided on said orientation film.

67. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising a ferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not having a helical structure of said ferroelectric liquid crystal between said substrates; and

a pixel comprising a transparent pixel electrode provided between said substrates.

wherein transmitted light amount of said pixel takes a halftone without occurrence of a domain.

68. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising a ferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not having a helical structure of said ferroelectric liquid crystal between said substrates; and

a plurality of pixels each comprising a transparent pixel electrode provided between said substrates,

wherein transmitted light amount of each of said pixels takes a halftone throughout an entire surface of the corresponding transparent pixel electrode.

69. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising an antiferroelectric liquid crystal provided between said substrates, said electro-optical modulating

layer not having a helical structure of said antiferroelectric liquid crystal between said substrates; and

a plurality of pixels each comprising a transparent pixel electrode provided between said substrates,

wherein transmitted light amount of each of said pixels takes a halftone without occurrence of a domain.

70. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising an antiferroelectric liquid crystal provided between said substrates, said electro-optical modulating layer not having a helical structure of said antiferroelectric liquid crystal between said substrates; and

a plurality of pixels each comprising a transparent pixel electrode provided between said substrates,

wherein transmitted light amount of each of said pixels takes a halftone throughout an entire surface of the corresponding transparent pixel electrode.

71. The device of claim 67 wherein said electro-optical modulating layer further comprises a resin.

72. The device of claim 68 wherein said electro-optical modulating layer further comprises a resin.

73. The device of claim 69 wherein said electro-optical modulating layer further comprises a resin.

74. The device of claim 70 wherein said electro-optical modulating layer further comprises a resin.

75. The device of claim 71 wherein said resin has a film shape.

76. The device of claim ~~68~~ 72 wherein said resin has a film shape.

77. The device of claim 73 wherein said resin has a film shape.

78. The device of claim 70 wherein said resin has a film shape.

79. The device of claim 71 wherein said resin has a protrusion.

80. The device of claim 72 wherein said resin has a protrusion.

81. The device of claim 73 wherein said resin has a protrusion.

82. The device of claim 74 wherein said resin has a protrusion.

83. The device of claim 71 wherein said resin comprises an acrylic resin.

84. The device of claim 72 wherein said resin comprises an acrylic resin.

85. The device of claim 73 wherein said resin comprises an acrylic resin.

86. The device of claim 74 wherein said resin comprises an acrylic resin.

87. The device of claim 71 further comprising an orientation film as a uniaxial orientation means.

88. The device of claim 72 further comprising an orientation film as a uniaxial orientation means.

89. The device of claim 73 further comprising an orientation film as a uniaxial orientation means.

90. The device of claim 74 further comprising an orientation film as a uniaxial orientation means.

91. The device of claim 87 wherein said resin is provided on said orientation film.

92. The device of claim 88 wherein said resin is provided on said orientation film.

93. The device of claim 89 wherein said resin is provided on said orientation film.

94. The device of claim 90 wherein said resin is provided on said orientation film.

95. The device of claim 71 wherein said liquid crystal electro-optical device is an active matrix type.

96. The device of claim 72 wherein said liquid crystal electro-optical device is an active matrix type.

97. The device of claim 73 wherein said liquid crystal electro-optical device is an active matrix type.

98. The device of claim 74 wherein said liquid crystal electro-optical device is an active matrix type.

99. A method for forming a liquid crystal electro-optical device comprising:

injecting a mixture of liquid crystal material and an uncured polymeric resin containing a monomer at 60 weight % or more between a pair of substrates having an orientation film over one of said substrates; and

hardening said resin under a state where said liquid crystal material exhibits a smectic phase and is oriented in an orientation direction of said orientation film.

100. The method of claim 99 wherein said smectic phase is a SmC* phase.

101. The method of claim 99 wherein said mixture contains said uncured polymeric resin at 20 weight %.

102. The method of claim 99 wherein said mixture contains said uncured polymeric resin at 5 weight %.

103. The method of claim 99 wherein said monomer comprises an acrylic monomer.

104. The method of claim 99 wherein said uncured polymeric resin comprises an ultraviolet curable resin, and said hardening step is carried out by ultraviolet ray irradiation.

105. The method of claim 99 wherein said resin is hardened into a film shape on said orientation film.

106. The method of claim 99 wherein said resin is hardened into a form of a plurality of protrusions on said orientation film.

107. The method of claim 99 wherein said liquid crystal material comprises a ferroelectric liquid crystal.

108. The method of claim 99 wherein said liquid crystal material comprises an antiferroelectric liquid crystal.

109. A liquid crystal electro-optical device comprising:

a pair of substrates;

an electro-optical modulating layer comprising a liquid crystal material provided between said substrates;

an electrode provided over each of said substrates for applying an electric field to said liquid crystal material;

an orientation film provided over one of said substrates; and

a resin provided between said orientation film and said liquid crystal material.

110. The device of claim 109 wherein said resin comprises an ultraviolet curable resin.

111. The device of claim 109 wherein said resin is a resin film.

112. The device of claim 109 wherein said resin has a plurality of protrusions.

113. The device of claim 109 wherein said liquid crystal material comprises a ferroelectric liquid crystal.

114. The device of claim 109 wherein said liquid crystal material comprises an antiferroelectric liquid crystal.

115. The device of claim 109 wherein said liquid crystal electro-optical device is an active matrix type.

116. A method for forming a liquid crystal electro-optical device comprising:

forming an orientation film over one of a pair of substrates each having an electrode;

rubbing said orientation film;

disposing said substrates to oppose said substrates to each other;

injecting a liquid crystal material between said substrates; and

forming a resin between said liquid crystal material and said orientation film.--